

Patent Application Number: 10/644,472

In the Claims

1. (Currently Amended) An encoding method for digital watermarking in a calibrated printing path, comprising:

(a) receiving a pixel ~~possessing~~ having cyan, magenta, and yellow color values ~~from~~ representing an input image;

(b) receiving, for each received pixel having cyan, magenta, and yellow color values representing an input image, a plurality of information bits, the plurality of information bits representing data to be encoded at a corresponding pixel in an output image;

(c) selecting a gray component replacement function ~~one of at least two~~ from a predetermined number of different GCR gray component replacement functions, for each received pixel, where the selection is based upon the state of said the received information bits for the received pixel;

(d) generating ~~CMYK~~ cyan, magenta, yellow and black output values for the received pixel using ~~said the~~ selected GCR gray component replacement function and said the cyan, magenta, and yellow color values of the received pixel, the generated black output value representing the data to be encoded at the corresponding pixel in the output image; and

(e) assigning ~~said the~~ CMYK cyan, magenta, yellow and black output values to ~~said the~~ corresponding pixel in ~~said the~~ output image.

Claim 2 (Cancelled)

3. (Currently Amended) The ~~An~~ encoding method, as claimed in claim 1, wherein the predetermined number of GCR gray component replacement functions to be selected from is dependent on the number of possible states of the data information bits intended to be encoded at each output image pixel.

4. (Currently Amended) The ~~An~~ encoding method, as claimed in claim 13, wherein the predetermined number of GCR gray component replacement functions to be selected from equals the number of states of the data information bits intended to be encoded at each output image pixel.

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5. (Currently Amended) The An encoding method, as claimed in claim 1, wherein a first received pixel having a first set of cyan, magenta, and yellow color values and a first set of corresponding plurality of information bits causes a same set of cyan, magenta, yellow and black output values to be generated as a second received pixel having a same first set of cyan, magenta, and yellow color values and a same first set of corresponding plurality of information bits and wherein a first received pixel having a first set of cyan, magenta, and yellow color values and a first set of corresponding plurality of information bits causes a different set of cyan, magenta, yellow and black output values to be generated as a second received pixel having a same first set of cyan, magenta, and yellow color values and a different set of corresponding plurality of information bits ~~said output image, when printed, exhibits the property that substantially similar colors occurring at different spatial locations in the input image are produced with substantially different CMYK combinations in the print.~~

Claims 6-7 (Cancelled)

8. (Currently Amended) The An encoding method, as claimed in claim 1, wherein a subset of the predetermined number of gray component replacement functions ~~at least two GCR functions~~ are optimized to carry information.

9. (Currently Amended) The An encoding method, as claimed in claim 1, wherein the plurality of information bits represent a watermark ~~intended to be encoded within said output image are represented with a tag~~

10. (Currently Amended) The An encoding method, as claimed in claim 1, wherein the plurality of information bits represent glyph data ~~intended to be encoded within said output image are represented with an auxiliary image plane.~~

Claims 11-15 (Cancelled)

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16. (Currently Amended) An encoding method for digital watermarking in a calibrated printing path, comprising:

- (a) receiving a pixel ~~possessing~~ having color values from representing an input image;
- (b) receiving, for each received pixel having color values representing an input image, a plurality of information bits, the plurality of information bits representing data to be encoded at a corresponding pixel in an output image;
- (c) selecting, for each received pixel, a mapping function from a predetermined number of mapping one of at least two different functions, the mapping functions that map input color values to output colorant values, where the selection is based upon the state of said the received information bits for the received pixel;
- (d) generating output colorant values for the received pixel using said the selected mapping function and said the input color values of the received pixel, one of the output colorant values representing the data to be encoded at the corresponding pixel in the output image; and
- (e) assigning said the output colorant values to said the corresponding pixel in said the output image.

17. (Currently Amended) A system for encoding a digital watermark in a calibrated printing path, comprising:

- an image processing circuit; and
- a device for rendering an output image;
- said image processing circuit receiving a pixel having cyan, magenta, and yellow color values representing an input image;
- said image processing circuit receiving, for each received pixel having cyan, magenta, and yellow color values representing an input image, a plurality of information bits, the plurality of information bits representing data to be encoded at a corresponding pixel in an output image;
- said image processing circuit selecting a gray component replacement function from a predetermined number of different gray component replacement functions, for each received pixel, based upon the received information bits for the received pixel;
- said image processing circuit generating cyan, magenta, yellow and black output values for the received pixel using the selected gray component replacement function and the cyan,

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magenta, and yellow color values of the received pixel, the generated black output value representing the data to be encoded at the corresponding pixel in the output image;

said image processing circuit assigning the cyan, magenta, yellow and black output values to the corresponding pixel in the output image;

said device rendering the assigned cyan, magenta, yellow and black output values as the output image ~~a processor in communication with a storage device; software and hardware resources sufficient to perform: a) receiving a pixel possessing color values from an input image; b) receiving a plurality of information bits to be encoded at a corresponding pixel in an output image; c) selecting one of at least two different GCR functions where the selection is based on the state of said received information bits; d) generating CMYK values using said selected GCR function and said color values; and e) assigning said CMYK values to said corresponding pixel in said output image; and a device for generating said output image.~~

Claim 18 (Cancelled)

19. (Currently Amended) The An system for encoding a digital watermark, as claimed in claim 17, wherein the predetermined number of GCR gray component replacement functions to be selected from is dependent on the number of possible states of the data information bits intended to be encoded at each output image pixel.

20. (Currently Amended) The An system for encoding a digital watermark, as claimed in claim 17, wherein the predetermined number of GCR gray component replacement functions to be selected from equals the number of states of the data information bits intended to be encoded at each output image pixel.

21. (Currently Amended) The An system for encoding a digital watermark, as claimed in claim 17, wherein a first received pixel having a first set of cyan, magenta, and yellow color values and a first set of corresponding plurality of information bits causes a same set of cyan, magenta, yellow and black output values to be generated as a second received pixel having a same first set of cyan, magenta, and yellow color values and a same first set of corresponding plurality of information bits and wherein a first received pixel having a first set of cyan, magenta,

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and yellow color values and a first set of corresponding plurality of information bits causes a different set of cyan, magenta, yellow and black output values to be generated as a second received pixel having a same first set of cyan, magenta, and yellow color values and a different set of corresponding plurality of information bits ~~said output image, when printed, exhibits the property that substantially similar colors occurring at different spatial locations in the input image are produced with substantially different CMYK combinations in the print.~~

Claims 22-23 (Cancelled)

24. (Currently Amended) The ~~A~~ an system for encoding a digital watermark, as claimed in claim 17, wherein a subset of the predetermined number of gray component replacement functions ~~at least two GCR functions~~ are optimized to carry information

25. (Currently Amended) The ~~A~~ an system for encoding a digital watermark, as claimed in claim 17, wherein the plurality of information bits represent a watermark ~~intended to be encoded within said output image are represented with a tag~~

26. (Currently Amended) The ~~A~~ an system for encoding a digital watermark, as claimed in claim 17, wherein the plurality of information bits represent glyph data ~~intended to be encoded within said output image are represented with an auxiliary image plane.~~

Claims 27-31 (Cancelled)

32. (Currently Amended) A system for encoding a digital watermark in a calibrated printing path, comprising:
an image processing circuit; and
a device for rendering an output image;
said image processing circuit receiving a pixel having color values representing an input image;

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receiving, for each received pixel having color values representing an input image, a plurality of information bits, the plurality of information bits representing data to be encoded at a corresponding pixel in an output image;

selecting, for each received pixel, a mapping function from a predetermined number of mapping functions, the mapping functions map input color values to output colorant values, based upon the received information bits for the received pixel;

generating output colorant values for the received pixel using the selected mapping function and the color values of the received pixel, one of the output colorant values representing the data to be encoded at the corresponding pixel in the output image;

assigning the output colorant values to the corresponding pixel in the output image;

said device rendering the assigned output colorant values as the output image~~a processor in communication with a storage device; software and hardware resources sufficient to perform:~~
~~a) receiving a pixel possessing color values from an input image; b) receiving a plurality of information bits to be encoded at a corresponding pixel in an output image; c) selecting one of at least two different functions that map input color values to output colorant values, where the selection is based on the state of said received information bits; d) generating output colorant values using said selected function and said input color values; and e) assigning said output colorant values to said corresponding pixel in said output image; and a device for generating said output image.~~